TENDENCIES AND PREDICTION OF PRICES OF INDUSTRIAL CROPS IN SERBIA

Nebojša NOVKOVI [1]*, Beba MUTAVDŽI [1], Ljiljana DRINI [2], Snežana JOVANOVI [3], Dragana TEKI [1]

[1]Faculty of Agriculture, University of Novi Sad, Serbia
[2]Faculty of Agriculture, University of Banja Luka, Bosnia and Herzegovina
[3]Institute of Maize, Zemun Polje, Serbia
*Corresponding author: nesann@polj.uns.ac.rs

ABSTRACT

The research in this paper deals with the prices of the most important industrial crops in Serbia – soybean, sunflower, sugarbeet, rapeseed and tobacco. The main aim of the research was to perform aquantitative analysisto determine the trends in the prices and to predict the trends for the following period. The analysis was based on the average annual prices for the period 2005-2019. The quantitative analysis was performed by using methods of descriptive statistics and the average annual rate of change to discover the trendsfor the analyzed period and to predict the trends for the following five years (2020-2024). The average annual price of soybean was 311.86 EUR/t. The price ranged between 189 and 527 EUR/t. The annual change rate of soybean price in Serbia in the analyzed period was 2.76%. The average annual price of sunflower was 264.78 EUR/t. The price ranged between 163 and 455 EUR/t. The annual change rate of sunflower price in Serbia was 2.13%. The average annual price of sugarbeet was 31.60 EUR/t. The price ranged between 24.36 and 40.31 EUR/t. The annual change rate of sugar beet price was 1.85 %. The average annual price of rapeseed was 299.58 EUR/t. The price ranged between 145 and 447 EUR/t. The annual change rate was 5.84%. The average annual price of tobacco was 1,749 EUR/t. The price ranged between 1,068 and 2,159 EUR/t. The annual change rate of tobacco price in Serbia was 3.90%.The predictions show that the expected prices for the industrial crops in 2024 in Serbia will be as follows: soybean 337, sunflower 266, sugar beet 35.33, rapeseed 425 and tobacco 2,208 EUR/t.

Keywords: *industrial crops, soybean, sunflower, sugarbeet, rapeseed, tobacco*, *prices prediction, Serbia.*

INTRODUCTION

Industrial crops include a group of crops whose fruits, leaves or other plant parts are used as raw materials in the processing and textile industries. By processing of these plants we obtain important food products: sugar, edible oil as well as

numerous by-products used in livestock nutrition includingsugarbeet pulp and meal.
Industrial crops are grouped according to botanical classification, or the products obtained from these plants:

- Oil crops–crops used for the production of edible oils obtained from fruits or seeds (e.g. sunflower, rapeseed, soybean, castor oil plant, flaxseed).
- Fiber crops – fiber is obtained from the stem, fruit or leaves (e.g. cotton, flax, hemp, jute, manila).
- Crops for production of starch, sugar and alcohol –swollen underground organs are used for obtaining sugar, starch and alcohol (e.g. sugarbeet, sugarcane, potatoes).
- Aromatic and spice plants.
- Medicinal plants – plant species in which the leaf, flower, fruit, root or stem contains a substance used for therapeutic purposes or cosmetic products (e.g. chamomile, sage, lavender).
- Other industrial crops– tobacco and hops.

Production of industrial crops depends on the agro-ecological conditions required for their cultivation. The Republic of Serbia has favorable natural conditions for the cultivation of industrial crops. These crops are grown on an area of 400 thousand hectares, which accounts for around 8% of the arable land in the Republic of Serbia. The most important crops produced in the country include sugar beet, sunflower and soybean.
The research in this paper is an analysis of the tendencies and prediction of the prices of the most important industrial crops in Serbia: soybean, sunflower, sugar beet, rapeseed and tobacco.
The aim of the paper is to use time series analysis of the prices of the industrial crops from the past period as a basis for predicting the absolute and relative prices of these industrial crops, and forecasting economic (market) conditions for the production of these crops.
There are numerous examples of applying quantitative methods in analyzing, modeling, forecasting and planning of economic characteristics of agricultural products and inputs in agriculture (Mutavdži et al. 2007; 2010; 2017; Novkovi et al. 2006; 2020; Novkovi , Mutavdži , Ivaniševi et al. 2016; Mihajlovi et al. 2018).

MATERIAL AND METHODS

The research methods applied in this paper were selected based on the described subject and aim of the research. The statistical methods included descriptive statistics and time series analysis.
The absolute prices and the price parities of the most important industrial crops in Serbia were analyzed by means of descriptive statistics for the period 2005–2019. The analysisincluded the basic statistical indicators: average value, extreme value

(minimum and maximum), coefficient of variation and average annual rate of change (r).

Prediction of the prices for theindustrial crops was carried out using of theaverage annual rate of change (r):

$$r = (G - 1)$$

$$G = \left(\frac{Y_n}{Y_1} \right)^{\frac{1}{n-1}}$$

where:
r = the average annual rate of change
G = the average annual index of change
Y_1 = the absolute value of the first member of the time series
Y_n = the value of the last number of the time series
n = the length of the series (the number of years).

The average annual prices of the industrial crops in the analysis were converted into euro per ton to enable comparison with foreign countries and to reduce the factor of domestic inflation. Conversion of the prices into euro was carried out according to the average annual exchange rate of euro based on the data of the National Bank of Serbia.

Based on the established parity change rates (r), the prediction was made for the period 2020–2024.

The data used in the analysis refer to the prices in Serbia. The price series in this paper are either taken from or formed on the basis of statistical publications of the Institution of Statistics of the Republic of Serbia.

RESULTS AND DISCUSSION

Descriptive analysis of the prices of industrial crops in Serbia

Sunflower is the most common industrial crop in Serbia. On average, it is grown on about 210 thousand hectares, with an annual production of around 616 thousand tons. In the analyzed period (2005-2019), the average annual price of sunflower was 264.58 EUR/t. The price ranged from the minimum price of 163.17 EUR/t in 2009, to the maximum price of 455.33 EUR/t in 2012. The coefficient of variation was relatively high – the highest of all analyzed industrial crops, amounting to 28.65%. The price of sunflower shows a trend of a slight increase at an average annual rate of 2.13%.

When observing the relative price movement, i.e. the parity between different industrial crops, the price of sunflower (as currently the most common industrial crop in Serbia) was taken as the standard.

Soybean is the second most common industrial crop in Serbia. It is grown on an average of 170 thousand hectares with an annual production of 598 thousand tons. The average annual price of soybeanwas 311.86 EUR/t, which is by 47.08 EUR/t,

or 17.78% more than the average price of sunflower. The annual price of soybean varied in the interval from 189.28 EUR/t in 2006 to 527.02 EUR/t in 2012. Soybean also had a high coefficient of variation of 25.27%. The price of soybean showed a trend of increase at an average rate of 2.76% per year.

The average relative price of soybean, i.e. soybean/sunflower price parity, was 1.21. This means that one ton of soybean was worth as much as 1.21 tons of sunflower. The price parity varied in the interval from 0.79 in 2010 to 1.76 in 2013. The coefficient of variation was the lowest in relation to all other observed price parities, amounting to 21.62%. The soybean/sunflower price parity had a positive trend in favor of soybean, but it was very low amounting to only 0.61% per year.Therefore, the price parity between these two oil crops in Serbia is considered to be stable.

Rapeseed is the third most important oilseed crop in Serbia. It is much less common compared to the previous two oil crops (produced on 24 thousand hectares, with an annual production of 69 thousand tons). The average annual price of rapeseed in the analyzed period was 299.56 EUR/t. That is around 12 EUR/t, or 4% lower than the price of soybean, or 35 EUR/t or 13% higher than the price of sunflower. The price of rapeseed varied from the minimum price of 144.60 EUR/t in 2005, to the maximum price of 446.93 EUR/t in 2012. The coefficient of variation of the rapeseed price was slightly lower than for the price of sunflower, amounting to 27.15%. The price of rapeseed showed a trend of increase at a relatively high annual rate of 5.84%.

The average price parity of rapeseed in relation to sunflower was 1.16. The most unfavorable parity was recorded in 2007, when a ton of rapeseed was worth 0.68 tons of sunflower, while the most favorable parity was in 2013, when one ton of rapeseed was worth as much as 1.7 tons of sunflower. The coefficient of variation for rapeseed/sunflower price parity in the observed period was 24.19%. The price parity shows a trend of increase in favor of rapeseed at an average annual rate of 3.66%.

Sugar beet is the third most cultivated industrial crop (after sunflower and soybeans) in terms of the harvested area in the Republic of Serbia, with an average harvested area of 46,000 hectares per year. The average price of sugar beet was 31.60 EUR/t. It ranged from 24.36 EUR/t in 2010 to 40.31 EUR/t in 2013. Sugar beet had the most stable prices of all analyzed industrial crops. The coefficient of variation was 15.86%. The price of sugar beet also recorded the lowest growth rate in the analyzed period compared to other industrial crops, amounting to only 1.85% per year.

Sugar beet/sunflower price parity averaged 0.13. This means that a ton of sugar beet was worth as much as 130 kg of sunflower. The parity varied from 0.07 in 2010 to 0.18 in 2013. The coefficient of variation was 25.07%. Sugar beet is the only crop showing a negative trend of the price parity in relation to sunflower. The rate of decline was very low, amounting to 0.53% per year,indicating that the relative price position of these two crops is stable, and that it will remain so in the future.

Tobacco is grown averagelyon less than 6,000 hectares in Serbia. The annual production is around 8 thousand tons. The average annual price of tobacco in the period from 2005-2019 in Serbia amounted to 1,749 EUR/t. The price varied in the analyzed interval from 1,068 EUR/t in 2005 to 2,159 EUR/t in 2013. As was the case with sugar beet, the price of tobacco also had a low coefficient of variation, which amounted to 16.07%. In the analyzed period, the price of tobacco showeda trend of increase at an average annual rate of 3.90%.

The average price parity of tobacco/sunflower was 7.01. It ranged from 4.15 in 2012 to 11.31 in 2009. This parity had the highest coefficient of variation of 28.48%. It showed atrend of increase in favor of tobacco, at an average annual rate of 1.73%.

Prediction of the prices for industrial crops in Serbia
Prediction of the prices and the price parities for the industrial crops in Serbia for the period 2020-2024 was conducted by applying the average rate of change calculated for the analyzed period 2005-2019. The rate of change (for the prices or price parities) was applied to the values obtained for 2019,in this way projecting the values for 2020. The values for the remaining prediction period were calculated in the same way (using the same rate of change).

Table 1 shows the projected values of the prices for certain industrial crops in Serbia for the following period.

Table 1. Predicted prices of industrial crops in Serbia (EUR/t) for the period 2020-2024

Crop	*Year*				
	2020	*2021*	*2022*	*2023*	*2024*
Sunflower	*244*	*249*	*255*	*260*	*266*
Soybean	*302*	*311*	*319*	*328*	*337*
Rapeseed	*339*	*359*	*380*	*402*	*425*
Sugar beet	*32.84*	*33.44*	*34.06*	*34.69*	*35.33*
Tobacco	*1,895*	*1,969*	*2,046*	*2,126*	*2,208*

The projected price of sunflower in 2024 will reach a value that is practically at the same level as the annual average from the previous period, while it is by 27 EUR/t or 11.3% higher than the price in 2019.

In 2024, the predicted price of soybean will be by 25 EUR/t or 8% higher than the average price in the analyzed period. The projected price in 2024 will be by43 EUR/t or 14.6% higher than in 2019. The difference between the prices of soybean and sunflower in 2024 will increase from 47 EUR/t, which was the average difference, to 71 EUR/t. This amount is higher even than in 2019, when the difference was 55 EUR/t. The projected average price for 2024 for the third observed industrial crop (rapeseed) will be by125 EUR/t or even 41.7% higher than the average price in the analyzed period. The projected price will be by 105 EUR/t or 32.8% higher compared to 2019.

In the last year of the prediction period, sugar beet will reach a price that is by 3.73 EUR/t or 11.8% higher than the average price in the analyzed period. Compared to 2019, the projected price of sugar beet in 2024 will be higher by 3.09 EUR/t or 9.6%.

The price of tobacco in 2024 will be higher than the average price in the analyzed period by 729 EUR/t, or 26.2%. Compared to the last year of the analyzed period, the price of tobacco will increase by 384 EUR/t or 21.1%.

Predictionsof the price paritiesfor the analyzed industrial crops in relation to the price of sunflower are shown in Table 2.

Table 2. Predictions of price paritiesfor industrial cropsin relation to the price of sunflower in Serbiafor the period 2020-2024

Crop	Year				
	2020	2021	2022	2023	2024
Soybean	1.2375	1.2451	1.2565	1.2603	1.2680
Rapeseed	1.3890	1.4399	1.4897	1.5442	1.6007
Sugar beet	0.1293	0.1283	0.1279	0.1273	0.1266
Tobacco	7.7620	7.8963	8.0329	8.1719	8.3132

The projected soybean/sunflower price parity in 2024 will be 4.8% higher than the average parity in the analyzed period, and by 3.1% higher than in 2019.

The projected price parity for rapeseed/sunflower in the last year of the prediction period will be by as much as 38% higher than the average parity, and by 19.5% higher compared to 2019.

Sugar beet is the only analyzed industrial cropwhose price parity will slightly decline in relation to the price of sunflower. The projected sugar beet/sunflower price parity in 2024 will be lower by 2.6% compared to the average parity (the same as compared to the last year of the analyzed period – 2019).

In the last year of the prediction period (2024), the average price parity of tobacco/sunflower will be by 18.6% higher than the average parityin the analyzed period, and by 9% higher than the parity in 2019.

CONCLUSION

Based on the scientific research conducted in this paper, it can be concluded that the prices of all analyzed industrial crops showed a tendency of increase in the period 2005-2019. The fastest growth was recorded for rapeseed (5.84% per year), while the lowest growth was determined for sugar beet (1.85%).

The most stable prices are determined for sugar beet and tobacco (coefficients of variation were 15.9% and 16%, respectively), while the prices of sunflower were the most unstable (coefficient of variation was 28.7%). Among the oilseed crops, soybean had the highest price (312 EUR/t), followed by rapeseed (300 EUR/t), and sunflower (265 EUR/t). However, the predictions show that this order will change. In the future period (2020-2024), the highest price will be achieved by rapeseed (425 EUR/t), followed by soybeans (337 EUR/t) and sunflower (226 EUR/t).

The price parities are very stable for sugar beet and soybean, while rapeseed and tobacco show trends of a significant increase in the price paritiesin relation to sunflower, and thus improvement of their relative price (market) position.

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